



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 5, May 2022

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.118

9940 572 462

6381 907 438

[ijrset@gmail.com](mailto:ijrset@gmail.com)

[www.ijrset.com](http://www.ijrset.com)

# Metal Shearing Machine by Using Pneumatic Pressure

Mrs. Sarika khare, Vaibhav Zeple, Sagar Mohite, Suyash Mokal, Ganesh Patil

Department of Mechanical Engineering, Bharti Vidhyapeeth Institute of Technology, Navi Mumbai, Maharashtra, India

**ABSTRACT:** The technology of pneumatics has gained tremendous importance in the field of automation from old fashioned timber works, machine shops and space robots. Certain characterizes of air have made this medium quite suitable for used in modern manufacturing and production industries. The air is compressed in an air compressor and from the compressor plant the flow media is transmitted to the pneumatic cylinder through a well laid pipe line system. So keeping in mind about the importance of pneumatic system, introducing a pneumatic sheet metal cutting.

## I. INTRODUCTION

### 1. SHEET METAL :

Sheet metal is simply a metal formed into thin and flat pieces. It is one of the fundamental forms used in metal working and can be cut and bent into a variety of different shapes. Countless everyday objects are constructed of the material. Thicknesses can vary significantly, although extremely thin thicknesses are considered foil or leaf, and pieces thicker than 6 mm (0.25 in) are considered plate. The thickness of the sheet metal is called its gauge. Commonly used steel sheet metal ranges from 30 gauge to about 8 gauge. The larger the gauge number, the thinner the metal. Gauge is measured in ferrous (iron based) metals while nonferrous metals such as aluminium or copper are designated differently; i.e., Coppers measured in thickness by Ounce. There are many different metals that can be made into sheet metal, such as aluminium, brass, copper, steel, tin, nickel and titanium.

### 2. SHEET METAL CUTTING:

Cutting processes are those in which a piece of sheet metal is separated by applying a great enough force to cause the material to fail. The most common cutting processes are performed by applying a shear force, and are therefore sometimes referred to as shearing processes. When a great enough shearing force is applied, the shear stress in the material will exceed the ultimate shear strength and the material will fail and separate at the cut location. This shearing force is applied by two tools, one above and one below the sheet. Whether these tools are a punch and die upper and lower blades, the tool above the sheet delivers a quick downward blow to the sheet metal that rests over the lower tool.

### 1.3. PENUMATIC SHEARING MACHINE:

Pneumatics is the branch of technology, which deals with the study and usage of pressurized gas to affect mechanical motion. Pneumatic sheet metal machine is a cutting machine tool designed to cut metal by applying pneumatic pressure.

Controlling of this machine is as easy as it is simple ON - OFF type. Because of compressible air, the equipment is less likely to be damaged by shock. There are numerous types of cutting machines are available in engineering field, but we are interested to introduce pneumatic system in sheet metal cutting machine.

## II. LITERATURE SURVEY

**MR. Shubhkumar M Bhandari (1)** Special Purpose Machines (SPM) are widely used in modern era of manufacturing. SPM are designed in such a way that they can easily perform the desired operations. SPM minimizes the operation time, human fatigue due to repetitive operation, product cost; it increases the productivity and assures the quality. The recent advancement in digital systems have now enabled us to make low cost machines. Sheet metal cutting is automatic machines like circle cutting New Changes and Cut according to marking with the help of Chisel and Hammer the primary process of all the processes.

**Butterworth-Heinemann (2)** Practically every industrial process requires objects to be moved, manipulated or be subjected to some form of force. This is generally accomplished by means of electrical equipment (such as motors or solenoids), or via devices driven by air (pneumatics) or liquids (hydraulics). Traditionally, pneumatics and hydraulics are thought to be a mechanical engineer's subject (and are generally taught as such in colleges). In practice, techniques

(and, more important, the fault finding methodology) tend to be more akin to the ideas used in electronics and process control. This book has been written by a process control engineer as a guide to the operation of hydraulic and pneumatics systems.

### 2.1. PNEUMATICS:

The word pneuma comes from Greek and means breather wind. The word pneumatics is the study of air movement and its phenomena is derived from the word pneuma. Today pneumatics is mainly understood to mean the application of air as a working medium in industry especially to driving and controlling of machines and equipment.

The compressibility of the air was first investigated by Robert Boyle in 1662 and he found that the product of pressure and volume of a particular quantity of gas is inversely proportional.

It is written as

$$PV = C \text{ (or) } P_1V_1 = P_2V_2$$

In this equation the pressure is the absolute pressure which is about 14.7 Psi and is of course capable of maintaining a column of mercury, nearly 30 inches high in an ordinary barometer.

### 2.2. SELECTION OF PNEUMATICS:

Mechanization is broadly defined as the replacement of manual effort by mechanical power. Pneumatic is an attractive medium for low cost mechanization particularly for sequential (or) repetitive operations. Many factories and plants already have a compressed air system, which is capable of providing the power (or) energy requirements and the control system (although equally pneumatic control systems may be economic and can be advantageously applied to other forms of power).

### 2.3. PRODUCTION OF COMPRESSED AIR:

Pneumatic systems operate on a supply of compressed air, which must be made available in sufficient quantity and at a pressure to suit the capacity of the system. When pneumatic system is being adopted for the first time, however it will indeed be necessary to deal with the question of compressed air supply. The key part of any facility for supply of compressed air is by means using reciprocating compressor.

### 2.4. RECIPROCATING COMPRESSORS:

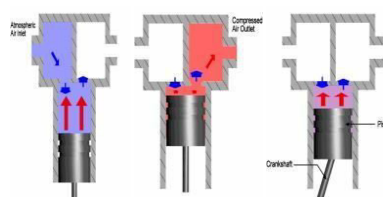


Fig.1. Working of Reciprocating air compressor

In this type of compressor a cylinder bore encloses a moving piston. As the crankshaft of the compressor rotates, the piston moves within the cylinder, similar to the piston in a car engine. As the piston is pulled down, the volume increases, creating a lower atmospheric pressure in the piston chamber. This difference in pressure causes air to enter via the inlet valve.

The most common type is the Two-Stage compressor. The following figures show how this compressor works.

Fig.2. Compressor work of two stage reciprocating compressor Built for either stationary (or) portable service the reciprocating compressor is by far the most common type. Reciprocating compressors can be had in sizes from the smallest capacities to deliver more than 500 m<sup>3</sup>/min. In single stage compressor, the air pressure may be of 6 bar machines discharge of pressure is up to 15 bars. Discharge pressure in the range of 250 bars can be obtained with high pressure reciprocating compressors that of three & four stages.

### III. SELECTION OF COMPRESSOR

It is vital for the effective and efficient running of a compressed air plant that the appropriate compressor is selected to meet the system needs.

#### 3.1.WORKING:

##### 3.1.1 COMPONENTS:

###### Piston

The piston is fitted in the cylinder block and reciprocates inside. When the solenoid valve supplies the air in the front end of the piston, the piston is pushed forward. This moves the hacksaw and the cutting stroke takes place. Then the solenoid valve supplies air to the rear end of the piston. The pressure is same but the contact area is less due to the presence of the

piston rod and pushes the piston at a greater pressure thus resulting in a fast return stroke. The material for the piston is Aluminum.

###### Base:

All the components of the machine are mounted on the base. It withstands the vibrations encountered during machining. It is mounted on the bench.

###### Cutting Blades:

A blade is used to cut the sheet metal in a desired dimension. Here we are using high speed steel blades to cut the sheet metal.

###### Solenoid Valve:

It is a 2x3 positional control valve. It receives the compressed air from the compressor and supplies to the cylinder block according to the signal, given by the timing device. During one position it supplies air to the front end of the cylinder block. During the next position it supplies air to the rear end of the cylinder block.

###### Flexible Hose:

The flexible hoses connect the solenoid valve and the cylinder block. Hoses are made of in layer of elastomer (or) synthetic rubber and braided fabric which takes up the higher pressure. If the hose is subjected to rubbing, it should be enclosed in a protective sleeve.

###### Cylinder block:

The cylinder block has two opening for admitting air inside the block for achieving the reciprocation motion of the piston. The material for cylinder block is Aluminum.

### IV. PRINCIPLE OF WORKING

The compressed air from the compressor reaches the solenoid valve. The solenoid valve changes the direction of flow according to the signals from the timing device. The compressed air pass through the solenoid valve and it is admitted into the front end of the cylinder block. The air pushes the piston for the cutting stroke. At the end of the cutting stroke air from the solenoid valve reaches the rear end of the cylinder block.



Fig 8..Pneumatic shearing machine

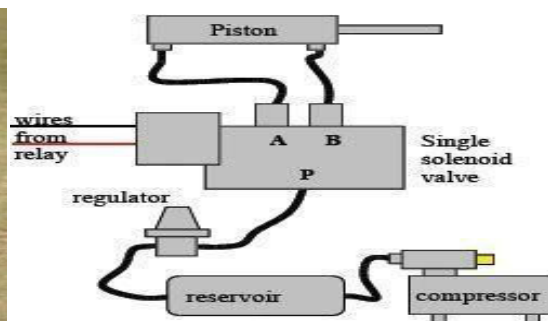


Fig.9.Pneumatic setup

#### 4.1. PNEUMATIC CIRCUIT:

The pneumatic circuit plays a vital role in this device, it is very necessary to explain the working of this circuit. Initially starting with air compresses, its function is to compress air from a low inlet pressure (usually atmospheric) to a higher pressure level. This is accomplished by reducing the volume of the air. Air compressors are generally positive displacement units and are either of the reciprocating piston type or the rotary screw or rotary vane types.

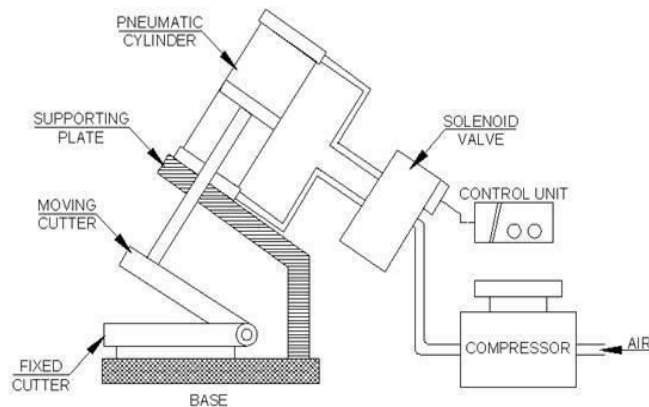


Fig.10. Pneumatic circuit

#### 4.2. SHEARED EDGE:

A variety of cutting processes that utilize shearing forces exist to separate or remove material from a piece of sheet stock in different ways. Each process is capable of forming a specific type of cut, some with an open path to separate portion of material and some with a closed path to cut out and remove that material.

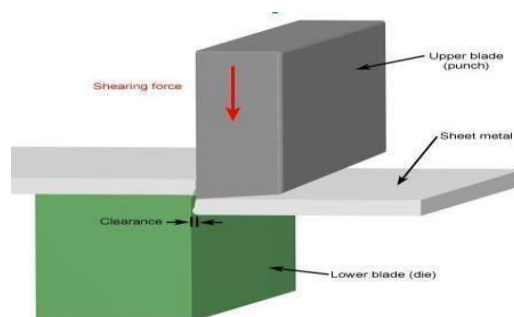


Fig.11. sheared edge

#### 5. APPLICATIONS:

- Car bodies
- Airplane wings
- Medical tables
- Roofs for buildings (Architectural) and many other things



- Sheet metal of iron and other materials with high magnetic permeability, also known as laminated steel cores, has applications in transformers and electric machines.
- Historically, an important use of sheet metal was in plate armure worn by cavalry, and sheet metal continues to have many decorative uses, including in horse tack.

Shearing machines have numerous industrial applications such as (pressing, cutting, bending, punching and drawing metal sheets) in various dimensions.

## VI. CONCLUSION

In the pneumatic shearing machine variable forces can be obtained by adjusting the pressure of the compressed air. This equipment can also be used to cut larger thickness sheets with some additional accessories are required. Pneumatic fluids are considered gases and are compressible. Pneumatic systems are not complete circuits. Air is used to do work and is then dumped into the atmosphere.

## REFERENCES

1. MR. Shubhkumar M Bhandari [1] Special Purpose Machines (SPM).
2. Antonio Esposito - Fluid power with application. Prentice hall of India private limited, 1980.
3. Pneumatic and hydraulic systems by Butterworth-Heinemann, Jordan Hill, Oxford, 1997.
4. Catalogue of Jana tic pneumatic product, Jana tic Private Limited Coimbatore.
5. Design data book –compiled by faculty of mechanical engineering
6. P.S.G. College of technology, Coimbatore
7. Festo Didactic KG – Fundamentals of control technology, Esslingen-1998.



**INNO SPACE**  
SJIF Scientific Journal Impact Factor  
**Impact Factor: 8.118**



**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details